

## Refine Search

Your wildcard search against 10000 terms has yielded the results below.

*Your result set for the last L# is incomplete.*

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

### Search Results -

Terms	Documents
(electro\$ with valve\$) and frequenc\$ and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and hetero\$ and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same (hetero\$ or (radio adj frequenc\$) or rf\$))	1

#### Database:

US Pre-Grant Publication Full-Text Database  
 US Patents Full-Text Database  
 US OCR Full-Text Database  
 EPO Abstracts Database  
 JPO Abstracts Database  
 Derwent World Patents Index  
 IBM Technical Disclosure Bulletins

#### Search:

L58	<input type="button" value="Refine Search"/>	
<input type="button" value="Recall Text"/>	<input type="button" value="Clear"/>	<input type="button" value="Interrupt"/>

### Search History

DATE: Saturday, February 17, 2007 [Purge Queries](#) [Printable Copy](#) [Create Case](#)

<u>Set</u>	<u>Name</u>	<u>Query</u>	<u>Hit</u>	<u>Set</u>
<u>Count</u>	<u>result</u>	<u>set</u>	<u>Count</u>	<u>Name</u>
1	L58	side by side	1	L58
		DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES;		
		OP=OR		
		(electro\$ with valve\$) and frequenc\$ and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and hetero\$ and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same (hetero\$ or (radio adj frequenc\$) or rf\$))	1	L58
		(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and hetero\$ and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$)))	0	L57
		L54 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and ((sum\$ or total\$ or add\$ or combin\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$)))	0	L56

<u>L55</u>	L54 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$)))	0	<u>L55</u>
<u>L54</u>	l50 or l52 or l53	34	<u>L54</u>
	<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L53</u>	(4030292   3982393   3910240   3644868   2166968   3691430   4033122   3708980   4109300   3827237   2771867)! [PN]	11	<u>L53</u>
	<i>DB=USPT,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L52</u>	("4106448"   "4631638"   "DE 2608152A"   "DE 3419781A") [ABPN1, NRPN, PN]	4	<u>L52</u>
	<i>DB=PGPB, USPT, USOC, EPAB, JPAB, DWPI, TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L51</u>	149	4	<u>L51</u>
	<i>DB=USPT, DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L50</u>	("4106448"   "4631638"   "DE 2608152A"   "DE 3419781A") [URPN]	19	<u>L50</u>
	<i>DB=PGPB, USPT, USOC, EPAB, JPAB, DWPI, TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L49</u>	4631638.pn. or 4106448.pn.	4	<u>L49</u>
<u>L48</u>	L47 and ((trigger\$ or excit\$ or actuat\$) near2 coil\$)	19	<u>L48</u>
<u>L47</u>	l45 or L46	28	<u>L47</u>
<u>L46</u>	@pd<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$)))	5	<u>L46</u>
<u>L45</u>	@ad<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and frequenc\$ and ((sum\$ or total\$ or add\$ or combin\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$)))	25	<u>L45</u>
<u>L44</u>	@ad<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and frequenc\$ and ((sum\$ or total\$ or add\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$) with combin\$))	0	<u>L44</u>
<u>L43</u>	@ad<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and ((sum\$ or total\$ or add\$) same ((hetero\$ or (radio adj frequenc\$) or rf\$) with combin\$))	0	<u>L43</u>
<u>L42</u>	@ad<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and ((hetero\$ or (radio adj frequenc\$) or rf\$) with combin\$)	0	<u>L42</u>
<u>L41</u>	@ad<=20030206 and (fuel\$ with inject\$) and (electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and ((hetero\$ or (radio adj frequenc\$) or rf\$) with combin\$)	0	<u>L41</u>
	<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L40</u>	L37 and (first\$ same (valve\$ with current\$)) and (second\$ same (valve\$ with current\$))	1	<u>L40</u>
<u>L39</u>	L37 and first\$ and second\$	1	<u>L39</u>
<u>L38</u>	L37 and (valve\$ with current\$)	1	<u>L38</u>
<u>L37</u>	4106448.pn.	1	<u>L37</u>
	<i>DB=PGPB, USPT, USOC, EPAB, JPAB, DWPI, TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		

<u>L36</u>	L35 and first\$ and second\$	1	<u>L36</u>
<u>L35</u>	L34 and (valve\$ with current\$)	1	<u>L35</u>
<u>L34</u>	L33 and (great\$ or big\$) and small\$ and ((cross\$ adj section) or "cross-section")	4	<u>L34</u>
<u>L33</u>	L31 or L32	94	<u>L33</u>
<u>L32</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and @pd<=20030206	91	<u>L32</u>
<u>L31</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and @ad<=20030206	94	<u>L31</u>
<u>L30</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and hetero\$	0	<u>L30</u>
<u>L29</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and @ad<=20030206 and (fuel\$ with inject\$) and hetero\$	0	<u>L29</u>
<u>L28</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and @ad<=20030206 and L25	0	<u>L28</u>
<u>L27</u>	L25 and L1 and @ad<=20030206	0	<u>L27</u>
<u>L26</u>	L25 and @ad<=20030206	155	<u>L26</u>
<u>L25</u>	(fuel\$ with inject\$ with valve) and hetero\$	261	<u>L25</u>
<u>L24</u>	L22 and hetero\$	0	<u>L24</u>
	<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L23</u>	L22 and hetero\$	0	<u>L23</u>
<u>L22</u>	(6209522   6422203)![PN]	2	<u>L22</u>
	<i>DB=USPT,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L21</u>	("6792916"   "EP 1298307A") [ABPN1,NRPN,PN]	2	<u>L21</u>
	<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L20</u>	L18	2	<u>L20</u>
	<i>DB=USPT,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L19</u>	("6792916"   "EP 1298307A")][URPN]	0	<u>L19</u>
	<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L18</u>	L16	2	<u>L18</u>
<u>L17</u>	L16 and hetero\$	0	<u>L17</u>
<u>L16</u>	6792916.pn.	2	<u>L16</u>
<u>L15</u>	9792916.pn.	0	<u>L15</u>
	<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L14</u>	("6792916")][URPN]	0	<u>L14</u>
	<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L13</u>	L7	1	<u>L13</u>
	<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>		
<u>L12</u>	(6422203   6209522)![PN]	2	<u>L12</u>
<u>L11</u>	("6792916")][PN]	1	<u>L11</u>
	<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES;</i>		

*OP=OR*

<u>L10</u>	L7	1	<u>L10</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L9</u>	("6792916")[URPN]	0	<u>L9</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L8</u>	L7	1	<u>L8</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L7</u>	6792916.pn.	1	<u>L7</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L6</u>	L5 and (vehic\$ or car\$ or automobile)	5	<u>L6</u>
<u>L5</u>	L4 and ((modulat\$ or chang\$ or edit\$ or var\$) near2 frequenc\$)	11	<u>L5</u>
<u>L4</u>	L2 or L3	121	<u>L4</u>
<u>L3</u>	"electromagnetic valve" and (clock with frequenc\$) and (pwm or pulse\$) and @pd<=20030206	116	<u>L3</u>
<u>L2</u>	L1	116	<u>L2</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L1</u>	"electromagnetic valve" and (clock with frequenc\$) and (pwm or pulse\$) and @ad<=20030206	116	<u>L1</u>

END OF SEARCH HISTORY

## Refine Search

### Search Results -

Terms	Documents
L37 and (first\$ same (valve\$ with current\$)) and (second\$ same (valve\$ with current\$))	1

**Database:**

US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

**Search:**

L40	<input type="button" value="Refine Search"/>	
<input type="button" value="Recall Text"/>	<input type="button" value="Clear"/>	<input type="button" value="Interrupt"/>

### Search History

DATE: Saturday, February 17, 2007 [Purge Queries](#) [Printable Copy](#) [Create Case](#)

<u>Set</u>	<u>Hit</u>	<u>Set</u>
<u>Name</u>	<u>Count</u>	<u>Name</u>
side by side		result set
DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
<u>L40</u> L37 and (first\$ same (valve\$ with current\$)) and (second\$ same (valve\$ with current\$))	1	<u>L40</u>
<u>L39</u> L37 and first\$ and second\$	1	<u>L39</u>
<u>L38</u> L37 and (valve\$ with current\$)	1	<u>L38</u>
<u>L37</u> 4106448.pn.	1	<u>L37</u>
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
<u>L36</u> L35 and first\$ and second\$	1	<u>L36</u>
<u>L35</u> L34 and (valve\$ with current\$)	1	<u>L35</u>
<u>L34</u> L33 and (great\$ or big\$) and small\$ and ((cross\$ adj section) or "cross-section")	4	<u>L34</u>
<u>L33</u> l31 or L32	94	<u>L33</u>
<u>L32</u> (electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or	91	<u>L32</u>

	pulse\$) and (fuel\$ with inject\$) and @pd<=20030206		
<u>L31</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and @ad<=20030206	94	<u>L31</u>
<u>L30</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and (fuel\$ with inject\$) and hetero\$	0	<u>L30</u>
<u>L29</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and @ad<=20030206 and (fuel\$ with inject\$) and hetero\$	0	<u>L29</u>
<u>L28</u>	(electromagnetic\$ with valve\$) and (clock\$ with frequenc\$) and (pwm\$ or pulse\$) and @ad<=20030206 and L25	0	<u>L28</u>
<u>L27</u>	L25 and L1 and @ad<=20030206	0	<u>L27</u>
<u>L26</u>	L25 and @ad<=20030206	155	<u>L26</u>
<u>L25</u>	(fuel\$ with inject\$ with valve) and hetero\$	261	<u>L25</u>
<u>L24</u>	L22 and hetero\$	0	<u>L24</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L23</u>	L22 and hetero\$	0	<u>L23</u>
<u>L22</u>	(6209522   6422203)![PN]	2	<u>L22</u>
<i>DB=USPT,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L21</u>	("6792916"   "EP 1298307A") [ABPN1,NRPN,PN]	2	<u>L21</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L20</u>	L18	2	<u>L20</u>
<i>DB=USPT,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L19</u>	("6792916"   "EP 1298307A") [URPN]	0	<u>L19</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L18</u>	L16	2	<u>L18</u>
<u>L17</u>	L16 and hetero\$	0	<u>L17</u>
<u>L16</u>	6792916.pn.	2	<u>L16</u>
<u>L15</u>	9792916.pn.	0	<u>L15</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L14</u>	("6792916") [URPN]	0	<u>L14</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L13</u>	L7	1	<u>L13</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L12</u>	(6422203   6209522)![PN]	2	<u>L12</u>
<u>L11</u>	("6792916") [PN]	1	<u>L11</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L10</u>	L7	1	<u>L10</u>
<i>DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR</i>			
<u>L9</u>	("6792916") [URPN]	0	<u>L9</u>
<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES;</i>			

*OP=OR*

L8 L7 1 L8

*DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR*

L7 6792916.pn. 1 L7

*DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR*

L6 L5 and (vehic\$ or car\$ or automobile) 5 L6

L5 L4 and ((modulat\$ or chang\$ or edit\$ or var\$) near2 frequenc\$) 11 L5

L4 L2 or L3 121 L4

L3 "electromagnetic valve" and (clock with frequenc\$) and (pwm or pulse\$) and @pd<=20030206 116 L3

L2 L1 116 L2

*DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR*

L1 "electromagnetic valve" and (clock with frequenc\$) and (pwm or pulse\$) and @ad<=20030206 116 L1

END OF SEARCH HISTORY

## Hit List

First Hit Your wildcard search against 10000 terms has yielded the results below.

***Your result set for the last L# is incomplete.***

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

<a href="#">Clear</a>	<a href="#">Generate Collection</a>	<a href="#">Print</a>	<a href="#">Fwd Refs</a>	<a href="#">Bkwd Refs</a>
<a href="#">Generate OACS</a>				

### Search Results - Record(s) 1 through 4 of 4 returned.

1. Document ID: US 5099802 A

L34: Entry 1 of 4

File: USPT

Mar 31, 1992

US-PAT-NO: 5099802

DOCUMENT-IDENTIFIER: US 5099802 A

TITLE: Method of operating a piston engine and fuel feeding mechanism therefor

<a href="#">Full</a>	<a href="#">Title</a>	<a href="#">Citation</a>	<a href="#">Front</a>	<a href="#">Review</a>	<a href="#">Classification</a>	<a href="#">Date</a>	<a href="#">Reference</a>	<a href="#">Sequences</a>	<a href="#">Attachments</a>	<a href="#">Claims</a>	<a href="#">KMC</a>	<a href="#">Drawn De</a>
----------------------	-----------------------	--------------------------	-----------------------	------------------------	--------------------------------	----------------------	---------------------------	---------------------------	-----------------------------	------------------------	---------------------	--------------------------

2. Document ID: US 4501140 A

L34: Entry 2 of 4

File: USPT

Feb 26, 1985

US-PAT-NO: 4501140

DOCUMENT-IDENTIFIER: US 4501140 A

TITLE: Fuel injection rate deducing system for a diesel engine

<a href="#">Full</a>	<a href="#">Title</a>	<a href="#">Citation</a>	<a href="#">Front</a>	<a href="#">Review</a>	<a href="#">Classification</a>	<a href="#">Date</a>	<a href="#">Reference</a>	<a href="#">Sequences</a>	<a href="#">Attachments</a>	<a href="#">Claims</a>	<a href="#">KMC</a>	<a href="#">Drawn De</a>
----------------------	-----------------------	--------------------------	-----------------------	------------------------	--------------------------------	----------------------	---------------------------	---------------------------	-----------------------------	------------------------	---------------------	--------------------------

3. Document ID: US 4304129 A

L34: Entry 3 of 4

File: USPT

Dec 8, 1981

US-PAT-NO: 4304129

DOCUMENT-IDENTIFIER: US 4304129 A

TITLE: Gas flow measuring apparatus

<a href="#">Full</a>	<a href="#">Title</a>	<a href="#">Citation</a>	<a href="#">Front</a>	<a href="#">Review</a>	<a href="#">Classification</a>	<a href="#">Date</a>	<a href="#">Reference</a>	<a href="#">Sequences</a>	<a href="#">Attachments</a>	<a href="#">Claims</a>	<a href="#">KMC</a>	<a href="#">Drawn De</a>
----------------------	-----------------------	--------------------------	-----------------------	------------------------	--------------------------------	----------------------	---------------------------	---------------------------	-----------------------------	------------------------	---------------------	--------------------------

4. Document ID: US 4106448 A

L34: Entry 4 of 4

File: USPT

Aug 15, 1978

US-PAT-NO: 4106448

DOCUMENT-IDENTIFIER: US 4106448 A

TITLE: Internal combustion engine and method of operation

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KOMC	Drawn De
------	-------	----------	-------	--------	----------------	------	-----------	-----------	-------------	--------	------	----------

Clear	Generate Collection	Print	Fwd Refs	Bkwd Refs	Generate OACS
-------	---------------------	-------	----------	-----------	---------------

Terms	Documents
L33 and (great\$ or big\$) and small\$ and ((cross\$ adj section) or "cross-section")	4

Display Format:

[Previous Page](#)

[Next Page](#)

[Go to Doc#](#)

## Hit List

---

First Hit Your wildcard search against 10000 terms has yielded the results below.

*Your result set for the last L# is incomplete.*

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.



Search Results - Record(s) 1 through 10 of 19 returned.

---

1. Document ID: US 5211080 A

L48: Entry 1 of 19

File: USPT

May 18, 1993

US-PAT-NO: 5211080

DOCUMENT-IDENTIFIER: US 5211080 A

TITLE: Method of shift control during a coastdown shift for an electronic automatic transmission system

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Abstract](#) | [Claims](#) | [DDOC](#) | [Drawn](#)

---

2. Document ID: US 5174334 A

L48: Entry 2 of 19

File: USPT

Dec 29, 1992

US-PAT-NO: 5174334

DOCUMENT-IDENTIFIER: US 5174334 A

TITLE: Noise control device for a solenoid-actuated valve

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Abstract](#) | [Claims](#) | [DDOC](#) | [Drawn](#)

---

3. Document ID: US 5115698 A

L48: Entry 3 of 19

File: USPT

May 26, 1992

US-PAT-NO: 5115698

DOCUMENT-IDENTIFIER: US 5115698 A

TITLE: Electronically-controlled, adaptive automatic transmission system

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Abstract](#) | [Claims](#) | [DDOC](#) | [Drawn](#)

---

4. Document ID: US 5027934 A

L48: Entry 4 of 19

File: USPT

Jul 2, 1991

US-PAT-NO: 5027934

DOCUMENT-IDENTIFIER: US 5027934 A

TITLE: Double-acting spring in an automatic transmission

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	INNOC	Drawn D.
------	-------	----------	-------	--------	----------------	------	-----------	--------	-------	----------

---

5. Document ID: US 4982620 A

L48: Entry 5 of 19

File: USPT

Jan 8, 1991

US-PAT-NO: 4982620

DOCUMENT-IDENTIFIER: US 4982620 A

TITLE: Method of learning for adaptively controlling an electronic automatic transmission system

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	INNOC	Drawn D.
------	-------	----------	-------	--------	----------------	------	-----------	--------	-------	----------

---

6. Document ID: US 4964506 A

L48: Entry 6 of 19

File: USPT

Oct 23, 1990

US-PAT-NO: 4964506

DOCUMENT-IDENTIFIER: US 4964506 A

TITLE: Pressure balanced pistons in an automatic transmission

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	INNOC	Drawn D.
------	-------	----------	-------	--------	----------------	------	-----------	--------	-------	----------

---

7. Document ID: US 4944200 A

L48: Entry 7 of 19

File: USPT

Jul 31, 1990

US-PAT-NO: 4944200

DOCUMENT-IDENTIFIER: US 4944200 A

TITLE: Method of applying reverse gear in an automatic transmission

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	INNOC	Drawn D.
------	-------	----------	-------	--------	----------------	------	-----------	--------	-------	----------

---

8. Document ID: US 4938102 A

L48: Entry 8 of 19

File: USPT

Jul 3, 1990

US-PAT-NO: 4938102

DOCUMENT-IDENTIFIER: US 4938102 A

TITLE: Method of adaptively scheduling a shift for an electronic automatic transmission system

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Search](#) | [Print](#) | [Claims](#) | [TOC](#) | [DRAFT](#)

---

9. Document ID: US 4936167 A

L48: Entry 9 of 19

File: USPT

Jun 26, 1990

US-PAT-NO: 4936167

DOCUMENT-IDENTIFIER: US 4936167 A

TITLE: Method of universally organizing shifts for an automatic transmission system

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Search](#) | [Print](#) | [Claims](#) | [TOC](#) | [DRAFT](#)

---

10. Document ID: US 4935872 A

L48: Entry 10 of 19

File: USPT

Jun 19, 1990

US-PAT-NO: 4935872

DOCUMENT-IDENTIFIER: US 4935872 A

TITLE: Method of shift selection in an electronic automatic transmission system

[Full](#) | [Title](#) | [Citation](#) | [Front](#) | [Review](#) | [Classification](#) | [Date](#) | [Reference](#) | [Search](#) | [Print](#) | [Claims](#) | [TOC](#) | [DRAFT](#)

[Clear](#) [Generate Collection](#) [Print](#) [Fwd Refs](#) [Bkwd Refs](#) [Generate OACS](#)

Terms	Documents
L47 and ((trigger\$ or excit\$ or actuat\$) near2 coil\$)	19

Display Format:  [Change Format](#)

[Previous Page](#)

[Next Page](#)

[Go to Doc#](#)

## Hit List

First Hit Your wildcard search against 10000 terms has yielded the results below.

***Your result set for the last L# is incomplete.***

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.



### Search Results - Record(s) 11 through 19 of 19 returned.

11. Document ID: US 4916961 A

L48: Entry 11 of 19

File: USPT

Apr 17, 1990

US-PAT-NO: 4916961

DOCUMENT-IDENTIFIER: US 4916961 A

TITLE: Cam-controlled manual valve in an automatic transmission



12. Document ID: US 4915204 A

L48: Entry 12 of 19

File: USPT

Apr 10, 1990

US-PAT-NO: 4915204

DOCUMENT-IDENTIFIER: US 4915204 A

TITLE: Push/pull clutch apply piston of an automatic transmission



13. Document ID: US 4907681 A

L48: Entry 13 of 19

File: USPT

Mar 13, 1990

US-PAT-NO: 4907681

DOCUMENT-IDENTIFIER: US 4907681 A

TITLE: Park locking mechanism for an automatic transmission



14. Document ID: US 4907475 A

L48: Entry 14 of 19

File: USPT

Mar 13, 1990

US-PAT-NO: 4907475

DOCUMENT-IDENTIFIER: US 4907475 A

TITLE: Fluid switching manually between valves in an automatic transmission

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	RDNC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--------	------	-------

---

 15. Document ID: US 4905545 A

L48: Entry 15 of 19

File: USPT

Mar 6, 1990

US-PAT-NO: 4905545

DOCUMENT-IDENTIFIER: US 4905545 A

TITLE: Method of controlling the speed change of a kickdown shift for an electronic automatic transmission system

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	RDNC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--------	------	-------

---

 16. Document ID: US 4887491 A

L48: Entry 16 of 19

File: USPT

Dec 19, 1989

US-PAT-NO: 4887491

DOCUMENT-IDENTIFIER: US 4887491 A

TITLE: Solenoid-actuated valve arrangement for a limp-home mode of an automatic transmission

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	RDNC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--------	------	-------

---

 17. Document ID: US 4875391 A

L48: Entry 17 of 19

File: USPT

Oct 24, 1989

US-PAT-NO: 4875391

DOCUMENT-IDENTIFIER: US 4875391 A

TITLE: Electronically-controlled, adaptive automatic transmission system

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	RDNC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--------	------	-------

---

 18. Document ID: US 4631628 A

L48: Entry 18 of 19

File: USPT

Dec 23, 1986

US-PAT-NO: 4631628

DOCUMENT-IDENTIFIER: US 4631628 A

TITLE: Electronic fuel injector driver circuit

Full	Title	Citation	Front	Review	Classification	Date	Reference				Claims	DDIC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--	--	--	--------	------	-------

19. Document ID: US 3131918 A

L48: Entry 19 of 19

File: USOC

May 5, 1964

US-PAT-NO: 3131918

DOCUMENT-IDENTIFIER: US 3131918 A

TITLE: Regenerative furnaces

DATE-ISSUED: May 5, 1964

INVENTOR-NAME: THOMAS FALLON JOHN

US-CL-CURRENT: 432/39; 432/133, 432/138, 432/23, 432/72

Full	Title	Citation	Front	Review	Classification	Date	Reference				Claims	DDIC	Drawn
------	-------	----------	-------	--------	----------------	------	-----------	--	--	--	--------	------	-------

Terms	Documents
L47 and ((trigger\$ or excit\$ or actuat\$) near2 coil\$)	19

Display Format:

[Previous Page](#)

[Next Page](#)

[Go to Doc#](#)

[First Hit](#) [Fwd Refs](#)[Previous Doc](#) [Next Doc](#) [Go to Doc#](#) [Generate Collection](#) [Print](#)

L48: Entry 18 of 19

File: USPT

Dec 23, 1986

DOCUMENT-IDENTIFIER: US 4631628 A

TITLE: Electronic fuel injector driver circuitAbstract Text (1):

A method of and apparatus for controlling the energization of an electromagnetic fuel injection valve in response to the production of an injector control pulse in an electronic fuel injection system. The driver circuit operates a current regulating power transistor into saturation until the current through the solenoid coil of the injector valve attains a predetermined peak current value. A comparator circuit deactivates the power transistor to stop the build-up of current through the coil. A switched free-wheeling circuit is enabled, remains activated, and starts conducting when the power transistor is deactivated by the comparator circuit so that some current continues to be supplied to the solenoid coil when the power transistor is off, thereby causing the current through the coil to decay slowly. When the solenoid current has decayed to a predetermined hold current level, the comparator circuit reactivates the power transistor and thereafter, due to hysteresis in the comparator circuit, cycles the power transistor on and off to substantially maintain the current through the coil at the predetermined hold current level. At the end of the injector control pulse, both the current regulating power transistor and the switched free-wheeling circuit are deactivated. Then, through multiple power dissipation pathways momentarily activated by the avalanching of a zener diode in series with the injector's solenoid coil, the energy stored in the solenoid coil and the current through the coil diminish rapidly to zero.

Application Filing Date (1):

19830608

Brief Summary Text (2):

The present invention relates to electronic fuel injection systems for internal combustion engines and in particular to an electronic control circuit for controlling the energization of electromagnetic fuel injection valves.

Brief Summary Text (4):

In throttle body injection systems, the metering of fuel is controlled by an electromagnetic injection valve. A fuel injector typically comprises a precise orifice which is connected through a solenoid valve to a source of pressurized fuel. The valve is actuated via energization of the solenoid coil by a pulsed electrical signal characterized by a pulse width (PW) and a frequency (f). The amount of fuel delivered is thus given by the formula:

**Search****Results****Help** Summary Text (11):

In multipoint fuel injection systems, the above control sequence is typically accomplished by operating a power transistor into saturation until the desired peak current is reached, turning the transistor off briefly until the injector current decays to the desired "hold" value, and then maintaining the "hold" current by operating the transistor in its active region until the transistor is turned off at the end of the pulse. However, because of high transistor power dissipation in the active "hold" region, relatively large heat sinks are required. While such heat dissipation is manageable in multipoint fuel injection systems where the individual

injectors are fairly small, in throttle body fuel injection systems where a single large injector is utilized to meter fuel flow, the increased force required to move the injector valve requires significantly higher current levels, resulting in commensurately higher levels of heat. For example, the current requirements of a multipoint fuel injector typically are I-peak/I-hold of 2A/0.5A respectively, while those of an exemplary single point fuel injector are 6-8.8A/1.5A. Thus, in automotive throttle body fuel injection applications, the active region method of maintaining "hold" currents may become impractical due to the difficulty of dissipating the increased levels of heat generated.

Brief Summary Text (12):

As a potential solution to this problem, it has been proposed that the desired injector holding current be maintained by rapidly switching the power transistor on and off at an appropriate switching frequency. This approach is taught, for example, in Schultzke et al., U.S. Pat. No. 4,180,026, assigned to Robert Bosch GmbH. The disadvantage of this approach, however, is that the induced voltage which develops in the injector winding during the periods when the transistor is turned off causes the injector current to decay rapidly during shut-off, thus requiring a relatively high switching frequency to avoid injector "chatter" and maintain the desired average holding current level. High switching frequencies can, however, cause switching dissipation and radio frequency interference problems. In addition, performance of the injectors may be less than optimal, particularly at small injector pulse widths.

Brief Summary Text (13):

Accordingly, it is the primary object of the present invention to provide an improved control circuit for an electronic fuel injection system.

Brief Summary Text (14):

In addition, it is an object of the present invention to provide an improved electronic fuel injection control circuit which produces highly consistent delays in the actuation of the fuel injector valve.

Brief Summary Text (15):

Furthermore, it is an object of the present invention to provide an electronic fuel injection control circuit which is capable of precisely controlling relatively large single port fuel injectors without creating a heat dissipation problem.

Brief Summary Text (16):

It is also an object of the present invention to provide an electronic fuel injection control circuit which provides improved linearity in the operation of the fuel injector.

Drawing Description Text (2):

FIG. 1 is a circuit diagram of an electronic fuel injector driver circuit according to the present invention; and

Drawing Description Text (3):

FIG. 2 is a timing diagram illustrating the operation of the electronic fuel injector driver circuit shown in FIG. 1.

Detailed Description Text (2):

Referring to FIG. 1, an electronic fuel injector driver circuit according to the present invention is shown. While the preferred embodiment of the present invention described herein is particularly suited for application with single-point throttle-body type fuel injection systems, it will be readily apparent that the invention is equally applicable to multi-point port-type fuel injection systems as well.

Detailed Description Text (3):

The solenoid coil which actuates the injector valve is adapted to be connected

across the terminals designated "Injector 1" and "Injector 2". The "Switched Battery" terminal is connected through the ignition switch of the vehicle to the battery, and the 5.0 volts supply line 20 is connected to a five volts regulated output of a power supply. The injector control pulse, which is produced by the main fuel injection control circuit (not shown) to signal the actuation of the injector, is supplied on line 17 and is designated INJ, as the presence of an injector pulse corresponds to a positive-going or HI logic pulse. The INJ signal is inverted via transistor QA to create an INJ signal on line 18. Operational amplifiers 22 and 24 are logic comparators of the open collector type adapted to produce an open (HI) signal at their output when the signal at their positive input exceeds the signal at their negative input and a LO output signal when the signal at their negative input exceeds the signal at their positive input. The transistors having a "U"-shaped designation adjacent the collector terminal, namely transistors Q120 and Q4, indicate power transistors which are mounted to a heat sink.

Detailed Description Text (4):

In general, the present fuel injector driver circuit 10 comprises a drive transistor Q120 which is connected in series with the injector coil (not shown but to be connected between the terminals labeled Injector 1 and 2), and a current sensing resistor R8 between the switched battery line 16 and ground, for controlling energization of the injector coil. Actuation of transistor Q120 is in turn controlled by switching transistor Q21 which has its base terminal connected to the INJ control line 18. Accordingly, when a HI injector control pulse on line 17 produces a LO signal on line 18, transistor Q21 is turned on, thereby forward biasing transistor Q120 and energizing the injector coil. During the injector pulse, the switching of transistor Q120 serves to regulate the current flow from line 16 to the injector coil, and this switching is controlled by comparators 22 and 24 and the current sensing resistor R8. In addition, a clamping transistor Q4 and a free-wheeling diode D3 are connected in series to the injector coil to provide a second current path to the injector coil, which (on account of the connection of transistor Q4 to transistor Q21 through resistor R15) remains enabled or activated throughout the duration of the injector control pulse, even when transistor Q120 is turned off. The purpose of this second current path will be subsequently explained in greater detail.

Detailed Description Text (14):

Thus, it will be appreciated that the present injector driver circuit initially operates the power transistor Q120 in saturation until the desired peak current is reached, and then allows the injector current to decay slowly through current-limited free-wheeling diode-transistor path while the current regulating power transistor Q120 is turned off until the desired hold current level is attained. Thereafter, the power transistor Q120 is cycled on and off at a relatively low frequency to maintain the injector current at the desired hold current level. At the end of the injector control pulse, both the power transistor and the switched free-wheeling diode path are deactivated to allow a large induced voltage and current to momentarily develop across the injector winding to facilitate very rapid but controlled decay of the power stored in the injector coil's magnetic field.

CLAIMS:

1. An electronic driver circuit for controlling the energization of a solenoid coil, forming part of an electromagnetic fuel injection valve, in response to an injector control pulse, produced by a main fuel injection control circuit, comprising:

a current regulating circuit including a power transistor connected in series with said coil, forming part of an electromagnetic fuel injection valve, and a current sensing resistor between a power source and ground, and a first switching transistor responsive to said injector control pulse, produced by a main fuel injection control circuit, for controlling the actuation of said power transistor;

a free-wheeling circuit connected in parallel with said power transistor and including a diode and a second switching transistor actuation of which is also controlled by said first switching transistor so that said free-wheeling circuit is operative to allow current to flow to said solenoid coil, forming part of an electromagnetic fuel injection valve, during said injector control pulse, produced by a main fuel injection control circuit;

a first comparator having one input thereof connected to said current sensing resistor and its other input thereof connected to receive a first reference signal from a reference circuit, said first reference signal being set so that said first comparator switches output states when the current through said coil attains a predetermined peak current value; the output of said first comparator being connected to said reference circuit for changing the value of said first reference signal when said first comparator switches output states so that said first comparator will not switch back to its original output state until the current through said coil, forming part of an electromagnetic fuel injection valve, is substantially equal to zero; and

a second comparator having its output connected to a third switching transistor which is in turn connected to said power transistor for controlling the actuation of said power transistor, said second comparator having one input thereof connected to said current sensing resistor and its other input connected to receive a second reference signal from said reference circuit; said second reference signal being set so that initially said second comparator switches output states in response to said first comparator switching output states to thereby actuate said third switching transistor and deactivate said power transistor; said second reference signal being thereafter changed by the effect of the switched output state of said first comparator on said reference circuit to a voltage value substantially equal to the voltage across said current sensing resistor when the current through said coil, forming part of an electromagnetic fuel injection valve, is equal to a predetermined hold current level; said second comparator further having positive feedback for providing a hysteresis effect to said second comparator for oscillating the output of said second comparator to cycle said power transistor on and off to substantially maintain the current through said coil, forming part of an electromagnetic fuel injection valve, at said predetermined hold current level;

said free-wheeling circuit remaining actuated during the off periods of said power transistor so that the current through said coil, forming part of an electromagnetic fuel injection valve, decays slowly when said power transistor is off.

4. The driver circuit of claim 1 further comprising multiple pathway power dissipation means for rapidly and controlledly dissipating energy stored in said solenoid coil, forming part of an electromagnetic fuel injection valve, through multiple pathways upon termination of said injector control pulse, produced by a main fuel injection control circuit.

[Previous Doc](#)    [Next Doc](#)    [Go to Doc#](#)

[First Hit](#) [Fwd Refs](#)[Previous Doc](#) [Next Doc](#) [Go to Doc#](#) [Generate Collection](#) [Print](#)

L48: Entry 18 of 19

File: USPT

Dec 23, 1986

US-PAT-NO: 4631628

DOCUMENT-IDENTIFIER: US 4631628 A

TITLE: Electronic fuel injector driver circuit

DATE-ISSUED: December 23, 1986

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Kissel; William R.	Milford	MI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Chrysler Motors Corporation	Highland Park	MI			02

APPL-NO: 06/502410 [PALM]

DATE FILED: June 8, 1983

INT-CL-ISSUED: [04] H01H 47/32

## INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	F02 D 41/20	20060101
CIPS	H01 H 47/22	20060101
CIPS	H01 H 47/32	20060101

US-CL-ISSUED: 361/154; 123/490

US-CL-CURRENT: 361/154; 123/490

FIELD-OF-CLASSIFICATION-SEARCH: 361/152, 361/153, 361/154, 361/155, 123/490

See application file for complete search history.

## PRIOR-ART-DISCLOSED:

## U.S. PATENT DOCUMENTS

[Search Selected](#)[Search ALL](#)[Clear](#)

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/> 4176387	November 1979	Harper	361/154
<input type="checkbox"/> 4180026	December 1979	Schulzke et al.	123/32EF

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
27530	March 1981	JP	361/154

ART-UNIT: 211

PRIMARY-EXAMINER: Gellner; Michael L.

ATTY-AGENT-FIRM: Calcaterra; Mark P.

ABSTRACT:

A method of and apparatus for controlling the energization of an electromagnetic fuel injection valve in response to the production of an injector control pulse in an electronic fuel injection system. The driver circuit operates a current regulating power transistor into saturation until the current through the solenoid coil of the injector valve attains a predetermined peak current value. A comparator circuit deactivates the power transistor to stop the build-up of current through the coil. A switched free-wheeling circuit is enabled, remains activated, and starts conducting when the power transistor is deactivated by the comparator circuit so that some current continues to be supplied to the solenoid coil when the power transistor is off, thereby causing the current through the coil to decay slowly. When the solenoid current has decayed to a predetermined hold current level, the comparator circuit reactivates the power transistor and thereafter, due to hysteresis in the comparator circuit, cycles the power transistor on and off to substantially maintain the current through the coil at the predetermined hold current level. At the end of the injector control pulse, both the current regulating power transistor and the switched free-wheeling circuit are deactivated. Then, through multiple power dissipation pathways momentarily activated by the avalanching of a zener diode in series with the injector's solenoid coil, the energy stored in the solenoid coil and the current through the coil diminish rapidly to zero.

4 Claims, 2 Drawing figures

[Previous Doc](#)    [Next Doc](#)    [Go to Doc#](#)

[First Hit](#) [Previous Doc](#) [Next Doc](#) [Go to Doc#](#)**End of Result Set** [Generate Collection](#) [Print](#)

L58: Entry 1 of 1

File: PGPB

Feb 26, 2004

DOCUMENT-IDENTIFIER: US 20040039514 A1

TITLE: Method and apparatus for controlling a gas-emitting process and related devices

**Summary of Invention Paragraph:**

[0003] The underlying objective of the ECU is to provide performance that optimizes fuel efficiency, drivability and reduction of harmful emissions. Signals concerning the state or condition of various operating characteristics of the engine are fed to the ECU. Typical engine operating characteristics as to which signals are inputted to the ECU are throttle position, intake manifold pressure, intake airflow, crank position, engine torque and air-to-fuel ratio (referred to as "lambda") value. Engine operating characteristics that may be adjusted for control in view of such inputs include fuel injection timing, spark advance, air-to-fuel ratio, exhaust gas recycle ("EGR") and idle air control motor. Although an engine is essentially a chemical plant oxidizing fuel with air into water, carbon dioxide and other chemical species, the only sensor currently capable of providing any information about the chemical status of the combustion process is the lambda sensor, which is limited to inferring a value for the air-to-fuel ratio of the engine based on measurements made in the stream of exhaust gases.

**Detail Description Paragraph:**

[0034] In the intake passage 38, there is provided a fuel injection valve 42 located in the vicinity of the intake port 30. The intake passage 38 further has a throttle valve 44 and an air-flow detector 46, which is located upstream of the throttle valve 44. At the upstream end of the intake passage 38, there is an air cleaner 48. In the exhaust passage 40, there is an air/fuel ratio (lambda) detector 50. Further, the exhaust passage 40 is provided with a catalytic device 52 of a type as known in the art. The engine is further provided with a sensor 54, such as an engine speed detector.

**Detail Description Paragraph:**

[0035] The fuel injection valve 42 is connected with a fuel supply source (not shown) and supplied with fuel under a controlled pressure. The valve 42 may be of the duty factor solenoid type in which the quantity of fuel injected through the valve 42 is determined by the duty factor of electric pulses applied to the valve 42. The CPU 4 actuates the valve 42 to control the quantity of fuel supplied to the engine, which is a parameter of the chemical reaction embodied in combustion.

**Detail Description Paragraph:**

[0036] The CPU 4 is connected with the outputs of sensors and detectors, preferably those that supply information about the compositional content of the exhaust gases, applies the decision-making routine to those outputs, and in turn produces output pulses that are routed to the fuel injection valve 42. The CPU 4 functions to calculate the quantity of fuel to be supplied to the engine on the basis of the engine operating condition as detected by various sensors and detectors so that a desired air-fuel ratio is established. For example, in a normal engine operating condition, it is preferred to maintain the stoichiometric air-fuel ratio, and the CPU 4 will in such case produce a basic fuel quantity signal which corresponds to

the fuel quantity required for providing an air-fuel mixture of the stoichiometric ratio. The reaction of combustion may also be controlled by adjusting the amount of oxygen (or oxygen source such as air) fed to the cylinder, or adjusting the spark advance in relation to information about the compositional content of the exhaust gases.

Detail Description Paragraph:

[0037] Of equal importance is the use of the methods and apparatus of this invention to control a device to which a product of a chemical reaction is transmitted. In the case of the combustion reaction in an engine, the exhaust gas stream itself is a product of the reaction, and it is transmitted to various devices such as the exhaust gas recirculation system or a pollution abatement device such as a catalytic converter and/or a device for the storage or abatement (reduction) of NO<sub>x</sub>. Information about the compositional content of the exhaust stream can be inputted from sensors and detectors to the ECU, which can utilize that information in a decision-making routine to output signals that control, for example, the settings on an exhaust recirculation valve, the extent of injection into an SCR catalytic converter of a reducing agent, or the regeneration of a NO<sub>x</sub> catalyst when contaminated with sulfur. Typical exhaust gases include oxygen, carbon monoxide, hydrogen, sulfur dioxide, ammonia, CO<sub>2</sub>, H<sub>2</sub>S, methanol, water, a hydrocarbon (such as C<sub>n</sub>H<sub>2n+2</sub>, and as same may be saturated or unsaturated, or be optionally substituted with hetero atoms; and cyclic and aromatic analogs thereof), a nitrogen oxide (such as NO, NO<sub>2</sub>, N<sub>2</sub>O or N<sub>2</sub>O<sub>4</sub>) or an oxygenated carbon (CO, CO<sub>2</sub> or C<sub>2</sub>H<sub>5</sub>OH). In certain embodiments, gases of interest may include one or more of NO<sub>x</sub>, hydrocarbons and ammonia. In certain other embodiments, however, it may be desired that the methods and apparatus not provide any signals, measurements, information or analysis with respect to oxygen.

Detail Description Paragraph:

[0049] FIGS. 7 and 8 show several possible locations of an array of sensor materials in an exhaust system. The engine in FIGS. 7 and 8 contains a mass airflow and outside temperature sensor 60, an idle air valve 62, a throttle position valve 64, an exhaust gas recycle valve 66, an air temperature sensor 68, a pressure sensor 70, an air intake 72, an intake manifold 74, fuel injectors 76, spark plugs 78, a crank position sensor 80, a cam position sensor 82, a coolant temperature sensor 84, a pre-catalytic converter 86, an emissions control device (such as a catalytic converter and/or a device for the storage or abatement of NO<sub>x</sub>) 90, and a temperature sensor 92. FIG. 7 shows three possible locations 94, 96, 98 for an array of chemo/electro-active materials, which may be upstream or downstream from the emissions control device. The arrows indicate the locations where it would be possible, if desired, to provide for the flow of information to/from the ECU to/from one or more sensors or actuators. Information gathered from an array of chemo/electro-active materials and processed by the ECU could be used, for example, to control the exhaust gas recycle valve 66 or the fuel injectors 76.

Detail Description Paragraph:

[0058] catalytic conditions, as regulated by rate of movement of a moving bed, or frequency of catalyst regeneration;

Detail Description Paragraph:

[0079] This invention is useful for detecting those gases that are expected to be present in a gas stream. For example, in a combustion process, gases that are expected to be present include oxygen, nitrogen oxides (such as NO, NO<sub>2</sub>, N<sub>2</sub>O or N<sub>2</sub>O<sub>4</sub>), carbon monoxide, hydrocarbons (such as C<sub>n</sub>H<sub>2n+2</sub>, and as same may be saturated or unsaturated, or be optionally substituted with hetero atoms; and cyclic and aromatic analogs thereof), ammonia or hydrogen sulfide, sulfur dioxide, CO<sub>2</sub>, or methanol. Other gases of interest may include alcohol vapors, solvent vapors, hydrogen, water vapor, and those deriving from saturated and unsaturated hydrocarbons, ethers, ketones, aldehydes, carbonyls,

biomolecules and microorganisms. The component of a multi-component gas mixture that is an analyte of interest may be an individual gas such as carbon monoxide; may be a subgroup of some but not all of the gases contained in the mixture, such as the nitrogen oxides (NO<sub>x</sub>), or hydrocarbons; or may be a combination of one or more individual gases and one or more subgroups. When a subgroup of gases is an analyte, a chemo/electro-active material will respond to the collective concentration within a multi-component gas mixture of the members of the subgroup together.

Detail Description Paragraph:

[0396] An electrical response is determined for each individual chemo/electro-active material separately from that of each of the other chemo/electro-active materials. This can be accomplished by accessing each chemo/electro-active material with an electric current sequentially, using a multiplexer to provide signals differentiated between one material and another in, for example, the time domain or frequency domain. It is consequently preferred that no chemo/electro-active material be joined in a series circuit with any other such material. One electrode, by which a current is passed to a chemo/electro-active material, can nevertheless be laid out to have contact with more than one material. An electrode may have contact with all, or fewer than all, of the chemo/electro-active materials in an array. For example, if an array has 12 chemo/electro-active materials, an electrode may have contact with each member of a group of 2, 3, 4, 5 or 6 (or, optionally, more in each instance) of the chemo/electro-active materials. The electrode will preferably be laid out to permit an electrical current to be passed to each member of such group of chemo/electro-active materials sequentially.

[Previous Doc](#)

[Next Doc](#)

[Go to Doc#](#)

[First Hit](#) [Previous Doc](#) [Next Doc](#) [Go to Doc#](#)**End of Result Set** [Generate Collection](#) [Print](#)

L58: Entry 1 of 1

File: PGPB

Feb 26, 2004

PGPUB-DOCUMENT-NUMBER: 20040039514

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040039514 A1

TITLE: Method and apparatus for controlling a gas-emitting process and related devices

PUBLICATION-DATE: February 26, 2004

## INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Steichen, John Carl	Landenberg	PA	US
Morris, Patricia A.	Montchanin	DE	US
Barnes, J.J. Sean	Hockessin	DE	US

APPL-NO: 10/406970 [PALM]

DATE FILED: October 14, 2003

## RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/370445, filed April 5, 2002,

INT-CL-PUBLISHED: [07] F02D 41/14

## INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	F01 N 11/00	20060101
CIPS	F02 D 41/14	20060101
CIPN	F01 N 3/08	20060101
CIPN	F01 N 3/20	20060101

US-CL-PUBLISHED: 701/109; 123/703, 123/674, 700/32

US-CL-CURRENT: 701/109; 123/674, 123/703, 700/32

REPRESENTATIVE-FIGURES: 6

## ABSTRACT:

Disclosed herein is a method and apparatus for controlling a process, such as a chemical reaction, that emits a multi-component mixture of gases; and for controlling a device to which is transmitted a product of a chemical reaction that emits a multi-component mixture of gases.

[First Hit](#) [Fwd Refs](#)[Previous Doc](#) [Next Doc](#) [Go to Doc#](#)[Search Results Set](#)[Search](#)  
[Results](#)  
[Help](#) [Generate Collection](#) [Print](#)[User Searches](#)[Preferences](#)

L35: Entry 1 of 1

File: USPT

Aug 15, 1978

Logout

US-PAT-NO: 4106448  
DOCUMENT-IDENTIFIER: US 4106448 A

TITLE: Internal combustion engine and method of operation

DATE-ISSUED: August 15, 1978

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Noguchi; Masaaki	Nagoya			JP
Sumiyoshi; Masaharu	Toyota			JP
Tanaka; Yukiyasu	Okazaki			JP
Tanaka; Taro	Chiryu			JP

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Nippon Soken, Inc.	Nishio			JP	03

APPL-NO: 05/657201 [PALM]  
DATE FILED: February 11, 1976

## FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	50-26375	March 3, 1975
JP	50-29232	March 10, 1975
JP	50-33719	March 19, 1975
JP	50-40709	April 2, 1975
JP	50-41692	April 4, 1975
JP	50-45685	April 14, 1975
JP	50-47926	April 21, 1975
JP	50-51047	April 25, 1975
JP	50-55781	May 9, 1975
JP	50-58234	May 15, 1975
JP	50-61223	May 21, 1975
JP	50-71774	June 12, 1975
JP	50-71778	June 12, 1975
JP	50-74958	June 18, 1975
JP	50-80419	June 28, 1975

INT-CL-ISSUED: [02] F02M 7/00, F02P 5/04, F02B 19/10, F02B 19/16

INT-CL-CURRENT:

TYPE IPC	DATE
CIPS <u>F02 D 41/00</u>	20060101
CIPS <u>F02 D 37/00</u>	20060101
CIPS <u>F02 D 41/24</u>	20060101
CIPS <u>F02 B 1/06</u>	20060101
CIPS <u>F02 B 19/00</u>	20060101
CIPS <u>F02 B 19/10</u>	20060101
CIPS <u>F02 B 1/00</u>	20060101
CIPS <u>F02 P 5/15</u>	20060101
CIPS <u>F02 D 37/02</u>	20060101

US-CL-ISSUED: 123/119LR; 60/285, 123/117R, 123/117A, 123/119A, 123/119A, 123/32SP, 123/198F, 123/32EB

US-CL-CURRENT: 123/268; 123/198F, 123/275, 123/443, 123/486, 123/568.27, 123/699, 60/285

FIELD-OF-CLASSIFICATION-SEARCH: 123/32SP, 123/32ST, 123/32EA, 123/32EB, 123/119LR, 123/127, 60/285, 60/274, 60/276, 60/278

See application file for complete search history.

PRIOR-ART-DISCLOSED:

U. S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>2166968</u>	July 1939	Rohlin	123/198F
<u>2771867</u>	November 1956	Peras	123/198F
<u>3708980</u>	January 1973	Truxell	60/276
<u>3827237</u>	August 1974	Linder	60/285
<u>3910240</u>	October 1975	Omori	123/32EA
<u>3982393</u>	September 1976	Masaki	60/274
<u>4030292</u>	June 1977	Masaki et al.	60/285
<u>4033122</u>	July 1977	Masaki et al.	60/285

ART-UNIT: 342

PRIMARY-EXAMINER: Cox; Ronald B.

ATTY-AGENT-FIRM: Cushman, Darby & Cushman

ABSTRACT:

All of combustion chambers receive a lean air-fuel charge at low and medium engine

power demands. As the engine power demand increases, a rich air-fuel charge is supplied to one or a suitable number of the combustion chambers with countermeasures being provided to suppress the formation of nitrogen oxides, such as, an exhaust gas recirculation (EGR) and the torch effect of a torch ignition system, the remaining combustion chambers, if any, receiving a lean air-fuel charge.

Exhaust gases from all of the combustion chambers are converged to oxidize hydrocarbons and carbon monoxide formed by the combustion of the rich air-fuel charge when the combustion chambers respectively receive rich and lean air-fuel charges.

254 Claims, 44 Drawing figures

[Previous Doc](#)

[Next Doc](#)

[Go to Doc#](#)